



# OSWER Innovations Pilot

## *Characterizing Environmental Contamination Through Airborne Hyperspectral Imaging*

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*The Office of Solid Waste and Emergency Response (OSWER) initiated a series of innovative pilots to test new ideas and strategies for environmental and public health protection. The creative projects test approaches to waste minimization, energy recovery, recycling, land revitalization, and homeland security that may be replicated across various sectors, industries, communities, and regions. We hope these pilots will pave the way for programmatic and policy recommendations by demonstrating the environmental and economic benefits of creative, innovative approaches to the difficult environmental challenges we face today.*

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### BACKGROUND

Following the accidental or deliberate release of hazardous materials, it is critical to locate, characterize, and identify a broad spectrum of chemical contamination as quickly as possible. Today, most of the work of locating and identifying the extent of contamination is done manually with portable instruments or by collecting samples for laboratory analysis. Existing innovative technologies, such as airborne hyperspectral imagery, are available to automate the process and increase the amount of area that can be searched. Recently, we have begun to evaluate the application of these technologies to several types of environmental contaminants, as well as the cost effectiveness of the collection and analysis process.

### PILOT APPROACH

Missouri Department of Natural Resources (MDNR), in cooperation with University of Missouri, Columbia, EPA Region 7, and EPA Office of Emergency Preparedness, Prevention and Response, proposes to determine whether hyperspectral imagery can enhance states' abilities to conduct large-scale characterization of contaminants of concern. MDNR and UMC will develop a list of surface contaminants, hazardous materials and waste, and environmental emergency conditions that are of concern to state agencies. Subsequently, UMC will identify areas in Missouri

where these contaminants or conditions exist and can be quantified from the ground. A library of existing spectral signatures will be assembled from commercial and government agencies that use multi-spectral or hyperspectral imagery. The project will collect commercial airborne hyperspectral imagery from several known contaminated sites, analyze this imagery, and develop hyperspectral signatures of the contaminants or environmental conditions. This initial set of hyperspectral signatures will be further evaluated at other known contaminated sites and tested against suspected sites. Multi- and hyperspectral signatures provided by other agencies also will be evaluated against imagery collected under this program. Depending upon available funding, the cooperative partners will acquire additional commercial images.

### INNOVATION

Airborne hyperspectral imagery has been used commercially for identifying oil-impacted surfaces, land use, mineral exploration, hazardous waste remediation, and a variety of other characterization projects. This project researches existing hyperspectral characterization algorithms or signatures for application to MDNR's requirements; develops a collection plan against known chemically contaminated sites with known surface contamination levels; collects commercial hyperspectral imagery from identified sites; and analyzes the collected data to evaluate the ability of the sensors to distinguish the

contaminants of interest. This pilot project expands on evaluations by other states and commercial entities and evaluates hyperspectral imaging against a broader spectrum of routine and emergency chemical contamination requirements.

## **BENEFITS**

This project will evaluate the application of hyperspectral imagery to Missouri's and other states' wide-area contamination characterization requirements and the potential use of this process for near-real time support to hazardous materials emergency response. Information of this type will provide value to the first responders community in the detection of surface contamination. Chemical and landscape profiles of many contaminated sites are very similar and these techniques could easily be transferred to other regions and programs.

## **CONTACTS**

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For additional information, visit the EPA OSWER Innovations web site at: [www.epa.gov/oswer/iwg](http://www.epa.gov/oswer/iwg).